EXECUTIVE SUMMARY

D-000250

EXECUTIVE SUMMARY

INTRODUCTION

This executive summary presents the "highlights" of the full briefing packet on Delta water quality for drinking water and agricultural purposes.

State, federal, and local water agencies having an interest in Delta water quality, as well as environmental groups, were invited to submit issue papers presenting their unique perspectives regarding drinking water quality and agricultural water quality. The full texts of these issue papers are included in this package. A brief, overall synopsis is presented here as an introduction to the full spectrum of viewpoints.

DRINKING WATER QUALITY

The Sacramento-San Joaquin Delta is a major source of drinking water for the majority of California's citizens. When treated, drinking water from the Delta generally meets current state and federal drinking water quality standards, though standards have been violated for some constituents at times. There are, however, serious concerns about the quality of Delta water as a drinking water source, and it is these problems which are one of the focuses of this paper.

Background:

Drinking water quality in California is maintained through a combination of state and federal regulatory systems. The Safe Drinking Water Plan for California, published by the Department of Health Services, is the State's master planning document for maintaining drinking water quality. The federal and state Safe Drinking Water Acts are the regulatory instruments through which drinking water standards are proposed, enacted, implemented, and enforced.

The federal Clean Water Act requires establishment of targeted standards to protect designated beneficial uses of specific water bodies. Municipal water supply is one of the designated beneficial uses of Delta waters. Point and non-point discharge control systems are the primary means of attaining water quality standards established under the Acts.

A number of drinking water standards are currently undergoing review and modification by the Environmental Protection Agency (EPA). The federal Surface Water Treatment Rule (SWTR) and the Disinfectants/Disinfection By-Products Rule (D/DBPR) will have profound effects on municipal users of Delta waters.

Unfortunately, given the current state of water treatment technology, these two regulations result in a quasi-Catch 22 situation. While the SWTR is designed to assure rigorous disinfection of drinking water, the D/DBPR restricts permissible levels of chemical by-products which are formed as a result of the rigorous disinfection mandated by the SWTR.

Delta waters are enriched in bromide and organic carbon; two constituents that cause problems in water treatment by complicating the attainment of the SWTR and the D/DBPR. Bromide, a salt ion in sea water, enters the Delta through intrusion of saline water from the Bay and ocean. Organic carbon (TOC) (naturally occurring as a result of plant decay processes) comes from a number of sources within and to the Delta. The most significant source of TOC is thought to be drainage from the Delta's peat soil islands, which may contribute up to half of the total TOC in Delta waters.

Disinfection by-products (DBPs) are of particular concern because some of the compounds produced as unwanted by-products of drinking water disinfection may pose a cancer threat. As a consequence of its enriched bromide and TOC levels, Delta waters present particular difficulties in the prevention or control of certain by-products, especially those formed in the presence of bromide.

Many informed observers believe the quality of Delta waters cannot be protected to the extent preferable for an important drinking water source. The watersheds tributary to the Delta drain about 25 percent of the land surface of California; and, in those watersheds, municipal and industrial waste water discharges, drainage from agricultural lands and municipal storm drains, recreational activities, and chemical spills contribute to water quality degradation. Within the Delta, sea water intrusion and drainage from Delta islands further reduce water quality. The lack of an ability to fully protect Delta source waters raises concerns about treatment reliability and the assurance of public safety.

The Delta's poor quality water increases costs for water purveyors and the public. Expensive new treatment plants and operational modifications have to be made to enable Delta waters to meet new, more rigorous drinking water standards.

The Metropolitan Water District (MWD) has estimated it will make a $120 million capital investment to meet the D/DBPR through advanced treatment techniques. Additionally, MWD's annual operating and maintenance costs could increase by $100 million to support this enhanced coagulation. Similarly, the Contra Costa Water District estimates its potential increase in annual operating and maintenance costs necessary to comply with the D/DBPR as about $400,000.

D-000252

Urban water agencies using Delta water have also indicated a concern over whether, even with large capital investments, proposed and future drinking water criteria can continue to be reliably met. Because the criteria must be met, however, these agencies believe there is no realistic alternative to implementing a combination of modified treatment and better source quality control. Through various studies, these agencies have identified a number of alternatives for improving the quality of Delta water; prominent among these are options for controlling drainage into the Delta, and alternatives for providing partial or complete isolation of the drinking water supply from the negative water quality influences of the Delta.

Members of environmental advocacy groups generally believe it is best to supply drinking water from the highest quality source available. However, environmental impacts can, and should, be limiting factors.

Some members of environmental advocacy groups have stated the opinion that treatment technology is sufficiently advanced to enable Delta waters to be adequately treated to protect consumer health, albeit at considerable cost. Therefore, in their view, continuing to take drinking water supplies from the southern Delta is an acceptable compromise of environmental and public health concerns.

PERSPECTIVES ON DRINKING WATER QUALITY

Beyond the discussion of drinking water quality of Delta source waters presented above, unique perspectives are held by the various state and federal agencies which have a stake in Delta water quality. A related, but somewhat different, perspective is held by local water agencies who receive, treat, and distribute Delta water for municipal and industrial use. Although a synopsis of the submitted papers is presented below, the reader is encouraged to pursue the full texts for a more complete discussion of the issues.

The **California Department of Health Services** notes that the new disinfection by-product (DBP) standards will not only be more stringent, but will also apply to all community water systems of more than 25 customers. Previous regulations applied only to systems with more than 10,000 customers. These smaller retailers typically do not have the technical expertise or financial resources to address the DBP problem adequately. This is especially the case for those drawing water directly from the Delta.

The new DBP standards are expected to be promulgated by the EPA in 1997. Systems with more than 10,000 customers will begin compliance efforts at that time, though planning for facilities to meet those standards needs to begin very soon. Smaller

D-000253

systems, with 25 customers or more, will have until 1999 to achieve compliance.

The **State Water Resources Control Board (SWRCB)** reports that the principal issues relating to Delta drinking water quality are sea water intrusion and elevated levels of disinfection by-product precursors in Delta source waters.

While treated drinking water from Delta sources meets the present state and federal water quality objectives for the DBP of current concern (trihalomethane(THM)), the Board recognizes future objectives EPA may set could potentially add great cost to the treatment process. Since the solution to DBP concerns does not lie solely with alternative water treatment technologies or relocation of existing Delta intakes, the Board believes the appropriate response to the EPA's proposed THM regulations is to perform additional monitoring and research. This needs to be completed before costly and unproven steps are taken. Moreover, further study may find other DBPs of greater concern and potential health risk.

To address specific concerns over DBPs, the Board believes municipal water agencies should, wherever feasible, strive to maintain bromide levels of 0.15 mg/1 or less in source waters. To attain this goal, water supply agencies using Delta source waters should:

- Encourage development of facilities which make maximum use of uncontrolled flows through off-stream storage.
- Encourage moving water supply intakes to locations which provide the best available water supply.
- Work with the State and regional Boards to eliminate problem discharges within the Delta.
- Continue the development of alternative water treatment technologies.

As the **U.S. Bureau of Reclamation** suggests consideration of alternative source control measures to better protect water quality in the Delta.

The **California Urban Water Agencies** urges the adoption of a water quality objective stating; "the quality of water provided to urban water suppliers should ensure continuous compliance with drinking water standards at a reasonable cost." Such an objective would include the following goals:

- The quality of water provided to urban water suppliers should be such that urban users will have a high degree of assurance that continuous compliance with state and

D-000254

federal drinking water standards will be feasible using proven technologies.

- The quality of water provided to urban water suppliers should be such that the cost of treatment to comply with drinking water standards is comparable to the cost of treating water originating from other major surface water sources such as the Sacramento River and the Colorado River.

The **Contra Costa Water District (CCWD)** faces significant challenges in using the Delta as a drinking water source. These challenges arise from constituents currently found in Delta source water and from the need to anticipate impacts of future EPA regulations.

- Current Delta water quality problems taxing the CCWD system are:

  Particulate loading; including sediment and microbiological pathogens.

  THM precursors; including organic carbon (TOC) and Bromides.

  Taste and odor problems.

  Nutrient loading; which promotes biological growths.

  Water quality variability; resulting from a lack of storage facilities to dampen significant water quality fluctuations which occur in the Delta.

- The proposed EPA D/DBP regulations could force CCWD to construct facilities to provide advanced treatment. This would require significant capital expenditure and result in substantial increases in annual operating and maintenance expenses.

The **Metropolitan Water District (MWD)** believes it is essential Delta source water protection issues be given a much greater emphasis. The major concerns MWD has relating to drinking water quality are:

- New drinking water regulations for disinfection and for the by-products of the disinfection process pose new technologic and economic challenges to water agencies using Delta source waters.

- Delta source waters have high concentrations of organic constituents which, when treated with standard disinfectant processes, produce levels of DBPs which approach, and often

D-000255

exceed, the proposed standards in portions of the MWD's distribution system.

- Delta source waters often have the added complication of elevated levels of bromide from sea water intrusion. Increased bromide concentrations essentially eliminate the use of ozone treatment, one of the more tested and cost-effective treatment processes which would normally be utilized to achieve the new DBP standard. This is because, in the presence of elevated bromide levels, ozone treatment forms other regulated DBPs.

- Without higher quality source water for State project water, new drinking water regulations will likely require installation of advanced treatment processes involving large capital expenditures and much higher annual operating and maintenance expenses.

- The MWD's access to other source waters to blend with Delta water provides flexibility in some portions of the MWD system to reduce concentrations of troublesome constituents. This flexibility is not always available to other agencies.

The **San Francisco Public Utilities Commission (PUC)**, which operates the San Francisco Water Department and Hetch Hetchy Water and Power, expressed concerns about the dramatic impact Delta water would have on its system if prolonged water shortages required permanent blending with its source waters.

Water from Hetch Hetchy Reservoir, the PUC's prime source of water, is of exceptional quality. The PUC's limited, but recent, experience of blending Delta water with its high quality Hetch Hetchy water has sensitized it to the direct and indirect system-wide impacts even small amounts of Delta water impose. Because its water system was not designed for treatment of Delta waters, extensive water treatment changes would have to be made to satisfy regulatory standards, even for those supplies coming from sources other than the Delta.

During the recent drought, supplemental Delta water was introduced into the PUC system, via the South Bay Aqueduct, and it had an immediate impact. System-wide THM levels increased to the violation range. To prevent algal blooms, the reservoir which stored the Delta water was treated with copper sulfate. Seasonal supplies from Crystal Springs Reservoir in San Mateo County showed increases in brominated THMs after treatment as a result of blending Delta waters with the local source waters.

The PUC's experience during the drought made it clearly evident that prolonged use of Delta waters in its system would unacceptably raise DBP levels in the absence of major treatment

D-000256

system modifications.

Even without the introduction of Delta water into the PUC system, the current DBP regulation/negotiation process being conducted by the EPA is of concern as an enhanced SWTR could force tens of millions of dollars in capital outlay and increased operation and maintenance costs. If Delta waters are mixed into the system, those expenditures would likely increase significantly.

The PUC's exposure to a relatively small amount of Delta water illustrates that its system-wide water quality is adversely affected by such blending and would require extraordinary change in its treatment system to permanently accommodate Delta water.

The **Santa Clara Valley Water District (SCVWD)** believes that securing the best source water quality possible, along with advanced treatment processes, should be preferred to relying solely on increasingly complex, advanced treatment processes.

- New EPA DBP regulations will likely require extensive capital improvements and impose significant additional operating and maintenance costs.

- Delta source waters have high concentrations of organic constituents which, when treated with standard disinfectant processes, produce levels of DBPs which approach, and often exceed, the new standards in portions of the SCVWD distribution system.

- The high variability in water quality of State project Delta source water poses challenges to the SCVWD's operations. This variability results, in part, from a lack of a storage buffer for South Bay Aqueduct supplies.

- Delta source waters often have the added complication of elevated levels of bromide from sea water intrusion. In order to achieve the new DBP standard, this elevated level of bromide essentially eliminates one of the more reliable and cost-effective treatment processes -- disinfection with ozone. This may force the SCVWD to install membrane filtration to meet the standards at a substantially higher capital cost, coupled with higher annual operating and maintenance costs.

- The SCVWD suffers seasonal taste and odor problems in Delta source waters, attributable to algae originating in Delta channels. The Central Valley Project (CVP) and State Water Project (SWP) attempt to reduce this problem by treating the aqueducts with copper sulfate. However, this treatment contributes to unwanted copper loading of San Francisco Bay through waste water treatment plant discharges.

AGRICULTURAL WATER QUALITY

Background:

Approximately 75% of the Delta (520,000 acres) is utilized in agricultural production, annually producing almost $500 million in various crops. This represents about 3 percent of statewide agricultural production.

All irrigation water for Delta agricultural land is diverted directly from Delta channels.

Delta water is also diverted from the southern Delta and conveyed through aqueducts to agricultural users in the San Joaquin Valley.

While water quality is a common concern for all agricultural users of Delta source waters, the Delta agricultural users and the San Joaquin Valley users have specific water quality concerns which are unique to the regions in which they irrigate.

Salinity is the most critical water quality concern shared by agricultural users of Delta source waters, both within the Delta and in the San Joaquin Valley.

Salt enters Delta waters from two main sources: sea water intrusion, resulting from tidal interaction with outgoing freshwater flows; and in certain parts of the Delta, agricultural drainage.

Salinity levels vary greatly within subregions of the Delta, as do the relative contributions of sea water and agricultural drainage to the total salinity level. For example, the West Delta, as a result of its proximity to the Bay's brackish waters, experiences high levels of sea water intrusion as compared to the Central and South Delta. Water quality in the interior Delta is significantly influenced by fresh water inflows: particularly those of the Sacramento River, which are drawn through the interior Delta by the CVP and SWP export pumps, producing lower salinity levels than in other regions of the Delta. Salinity levels in the South Delta, conversely, reflect higher concentrations of dissolved salts contributed by agricultural drainage conveyed by the San Joaquin River; producing a different water quality focus than that of the Central or West Delta. Agricultural users in the San Joaquin Valley are more generally concerned with the total salt load transported into the Valley through importation of Delta water supplies.

The primary reason water quality is of such concern to agricultural users of Delta source waters is that the salinity of applied water has a direct relationship to salt content in the

D-000258

soil solution, which in turn affects crop yields and leaching[1] requirements. Several studies have been conducted by the State Water Resources Control Board (SWRCB) in an attempt to better define this relationship.

Some of the more recent studies, utilizing small-plot tests for corn yield on a Delta island, have concluded that crop yields can be maintained with higher salinity levels than those required under previously adopted SWRCB standards. However, serious questions have been raised concerning whether the findings of these studies can be extrapolated from the relatively small agricultural operation studied in the test program to the larger scale agricultural production fields common in the Delta. Specifically, the agricultural industry is skeptical whether the leaching techniques used on the study plots, and required by the application of higher salinity water, can be physically and economically implemented on a large scale. Additional studies, under the auspices of the SWRCB, are currently underway in an attempt to address this uncertainty.

A significant factor in the relationship between water quality and agricultural yield is the differing needs of varying soil types in the Delta.

Soils in the Delta fall generally into two categories; organic and mineral. Western and interior portions of the Delta are mainly organic soil areas, while mineral soils are concentrated in the Southern Delta.

Management strategies and cropping patterns vary depending on soil type. The most important differences in management strategies revolve around irrigation techniques and leaching requirements.

Subirrigation[2], or managed changes in groundwater table elevations, is the predominant method of irrigation in organic soil locations since they are generally well below sea level and consequently overlie high groundwater table levels. Unlike irrigation techniques applicable to other soil types, subirrigation is not conducive to continuous leaching. As a result, the extensive and costly requirements of leaching organic soils makes agriculture in organic soil locations within the

---

[1]Leaching is the process of applying water to an agricultural field in a manner meant to flush accumulated salts out of the root zone, and to control or prevent salt accumulation in the soil.

[2]Subirrigation is the practice of applying water from beneath the soil surface rather than from on top. The technique is discussed in more detail in the main briefing paper.

Delta more sensitive to salinity concentrations in adjacent Delta channels than like operations in mineral soils.

Conventional irrigation methods (furrows and sprinklers) are generally used to irrigate mineral soils and leaching practices for this soil type can follow more traditional techniques.

The current salinity objective of 0.45 EC (electrical conductivity, the standard measure) for Delta channels was set by SWRCB Decision 1485. During more recent hearings before the SWRCB, information from the studies discussed above were presented for consideration in relation to a proposal to relax the salinity objective. However, the absence of data on the economic impact of the proposal, and Board concerns that additional study was needed of large-scale use of the recommended techniques, led the SWRCB to keep the current standard intact until additional data is available.

Although Delta source water users in the South Delta and San Joaquin Valley have a similar concern over salinity, they have different needs relative to addressing the problem. The primary issue is reducing the salt load in Delta waters diverted for agricultural uses in the Valley. A companion issue is developing a satisfactory method of moving the salts accumulated in Valley drainage water through the Delta and into receiving waters which will not be adversely impacted by addition of the salt load. Under the current drainage system, salts transported by Delta diversions to agricultural users in the San Joaquin Valley are subsequently leached from the soil, collected in drains, transported to the San Joaquin River, and ultimately end up back in the South Delta at higher concentrations.

The total salt load transported to the San Joaquin Valley can only be addressed by reducing the salinity levels of irrigation water applied in the Valley or, failing that, by reducing the volumes of irrigation water used.

Attempts to develop a method to remove salts from the San Joaquin Valley as they accumulate have a long history of only partially successful initiatives -- for example, the incomplete San Joaquin Valley Drain. Recently, the focus has been on two programs. The oldest of these programs is the San Joaquin Valley Drainage Program.

The state-federal San Joaquin Valley Drainage Program culminated approximately six years of study in September, 1990, with a report entitled "A Management Plan for Agricultural Subsurface

Drainage and Related Problems on the Westside San Joaquin Valley". This report focused on in-valley management of agricultural drainage and drainage-related problems.

The state and federal agencies involved in developing the plan recognized that "unattended plans often do not materialize" and prepared a strategy for implementation of the management plan.

The strategy identified critical actions required to implement the report's recommendations and proposed a plan, an organizational structure, a schedule, and a budget to accomplish these actions. A Memorandum of Understanding (MOU) was executed between the eight agencies adopting the strategy.

To date, while the management group continues to meet on a regular basis, a lack of financial and staff resources has hampered implementation.

The most recent program is one that has been pursued by local agricultural water interests, partially in response to a SWRCB direction to the Central Valley Regional Water Quality Control Board (CVRWQCB) to implement a salinity reduction plan for the San Joaquin River. A proposal has been developed to revise agricultural drainage systems in appropriate portions of the CVP service area. Drainage would be retained subsurface and then released to the San Joaquin River only when instream flows were high enough to provide adequate dilution and to flush accumulated salts through the Delta to more naturally brackish waters. This plan is expected to be presented to the CVRWQCB soon, with the recommendation that funding be appropriated for implementation of pilot studies in the next few years which would reconstruct several existing on-farm subsurface drainage systems and test their effectiveness in improving San Joaquin River quality.

PERSPECTIVES ON WATER QUALITY FOR AGRICULTURAL USES

The **Department of Water Resources (DWR)** believes it is reasonable to distinguish between the western Delta and the interior Delta when setting agricultural water quality objectives. It bases this opinion on the grounds that there are greater water supply costs to upstream and Delta diverters associated with meeting western Delta agricultural water quality objectives than with meeting central Delta objectives. Therefore, to make the most effective use of Delta water supplies, it is reasonable to expect western Delta agricultural water users to employ more effective or more frequent leaching practices to manage the salinity of their fields.

In addition, DWR believes that the "corn study" data presented in the latest SWRCB hearings should be used as a basis for setting new, less-restrictive salinity objectives for Delta channels.

The **State Water Resources Control Board (SWRCB)** notes that water quality objectives they adopted for agricultural use of Delta water are based on protecting crops grown in a specific area. The Board does not intend to adjust the western Delta and interior Delta agricultural water objectives until more economic data is available from studies now in progress on the costs of leaching and the ability of farmers to pay them. The objectives set in the 1991 Water Quality Control Plan for the South Delta can be revised if a three-party agreement is executed.

Delta water agencies emphasize they need high quality water for salt sensitive crops grown in their districts. These agencies contend that in-channel water quality has declined since the early 1950's and water quality in the San Joaquin River has similarly been degraded. Consequently, continued emphasis on improving water quality from these sources has to be maintained.